

THE GENUS *ERYTHRONIUM* (LILIACEAE) IN KANSAS¹

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ABSTRACT

Three species of *Erythronium* are recognized in Kansas, *E. rostratum* Wolf, *E. albidum* Nutt. and *E. mesochoreum* Knerr. *Erythronium rostratum* has erroneously been considered *E. americanum* Ker and both this species and *E. propullans* Gray are excluded from the state flora. *Erythronium mesochoreum* is recognized as distinct from *E. albidum* based on differences in chromosome number, the first diploid and the second tetraploid, and by different tendencies in vegetative reproduction, leaf morphology, perianth and fruiting characters as well as in habitat.

The genus *Erythronium* (Liliaceae) consists of one Eurasian, one Japanese, 4-6 eastern North American, and 17-24 western North American species. Five species are reported from Kansas, but the yellow-flowered *Erythronium* found in southeastern Kansas and adjacent Missouri had not been positively identified, the delimitation of white-flowered taxa was not clear, and several doubtful records for the state existed. This study was undertaken to resolve these questions.

YELLOW-FLOWERED SPECIES

The first eastern American species of a yellow-flowered *Erythronium* described was *E. americanum* by Ker (1808). Wolf (1941) described *E. harperi* and *E. rostratum*, though Parks & Hardin (1963) reduced *E. harperi* to *E. americanum* subsp. *harperi*.

Parks & Hardin examined specimens of *Franklin & McGregor E316* (NCSC) and *McGregor 15225* (US) and tentatively (without fruit) identified these specimens collected in Cherokee Co as *E. rostratum*. My own collections from this area (93, 96, 121, 136, 149) also are *E. rostratum*. Mature fruit was not seen; little or no fruit was apparently set in the colonies examined. In most flowers, the ovary withered soon after the tepals dropped; however, on some plants the ovary enlarged somewhat though the ovules within did not. These immature capsules were ellipsoidal with a prominent beak and were held erect. The specimens resembled those collected at the type locality by *Harper 3832* (KSC) and an isoelectotype *Morgan s.n.* (US 1786963).

Steyermark (1963) concluded that the yellow-flowered *Erythronium* found in southwestern, south central, and scattered southeastern and east central counties

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of Missouri is *E. americanum* f. *americanum*. However, one of my collections from southwestern Missouri, in Christian Co, proved to be *E. rostratum* as did the relevant specimens at MO, i.e. those from southwestern Missouri, northwestern Arkansas, eastern Oklahoma and southeastern Kansas, while those from south-central and east-central Missouri and adjacent Illinois were *E. americanum* subsp. *americanum*. Apparently, Steyermark failed to distinguish the two species.

The chromosome number for *E. rostratum* was found to be $2n = 24$ (Appendix 1) confirming the report by Parks & Hardin (1963). All chromosomes have subterminal centromeres. The majority of species of *Erythronium* including the diploids *E. umbilicatum* Parks & Hardin, *E. grandiflorum* var. *pallidum* St. John, *E. revolutum* Smith, *E. montanum* S. Wats., *E. hendersonii* S. Wats., *E. oregonum* Appl., *E. dens-canis* L., *E. californicum* Purdy and the tetraploids *E. americanum* Ker and *E. americanum* subsp. *harperi* (Wolf) Parks & Hardin (Darlington & Wylie, 1955) have a basic number of $x = 12$ and all have subterminal centromeres.

WHITE-FLOWERED SPECIES

Nuttall (1818) described the eastern white-flowered *Erythronium* as *E. albidum*, distinguished by its mottled leaves, recurved tepals, the production of long horizontal stolons on immature forms, and its habitat in dense woods. Burgess (1877) and Panton (1877) independently reported from Iowa and Kansas, respectively, a white *Erythronium* differing from *E. albidum* by its narrower leaves which were unmottled, the tepals not recurved, and found in prairies rather than in woods. Neither worker named the form. It was validated by Knerr (1891a) from material collected in Atchison Co, Kansas who named it *E. mesochoreum*. Later, Knerr (1891b) altered the spelling to *E. mesochoreum*. In his original paper, Knerr stated that the name meant Midland *Erythronium*; thus "mid-" would come from the Greek "mesos" which is prefixed "meso-" and so the spelling in the second paper is a correction for an orthographic error. Meads (1893) studied specimens of *E. albidum* from Michigan and *E. mesochoreum* obtained from Knerr. She suggested that the latter be considered as a variety of *E. albidum* but did not formally propose this reduction. Rickett (1937) found the separation of *E. albidum* and *E. mesochoreum* difficult near Columbia, Missouri and concluded that *E. mesochoreum* was an ecotype of *E. albidum* and proposed *E. albidum* var. *mesochoreum* (Knerr) Rickett. In his unpublished thesis using anatomical, morphological, and bio-systematical methods, Ireland (1957) concluded that *E. mesochoreum* be relegated to subspecific status under *E. albidum*. However, he observed that when both taxa were planted in a common experimental garden they remained distinct.

Sterns (1888) described *E. albidum* var. *coloratum* based on material collected in McLennan Co, Texas in shaded woods near streams with white tepals more or less suffused with rose purple varying to bright red and leaves more strongly mottled with green and brown than in the typical variety. Shinnars (1958) considered this variety synonymous with *E. albidum* var. *mesochoreum* and described it as having fewer stolons, either vertical or short and horizontal, colony composed predominantly of flowering plants with few sterile individuals, tepals lavender to

white, and found in open woods, thickets, and ravines bordering prairies; moreover his illustration shows a nonreflexed perianth and unmottled leaves. Steyermark (1963) did not agree with Shinnars and stated that Sterns description seemed to apply more to a color variant of *E. albidum* rather than to *E. albidum* var. *mesochoreum*. I agree with Steyermark for the description given by Shinnars of *E. albidum* var. *coloratum* is quite different from the original of Sterns while resembling that of *E. albidum* var. *mesochoreum*. I have examined specimens which were definitely *E. albidum* var. *mesochoreum* from near Ft. Worth and it seems likely that Shinnars was referring to this taxon in his description of *E. albidum* var. *coloratum*.

Leaf morphology.

To determine the value of leaf size in separating *E. albidum* and *E. mesochoreum*, measurements of herbarium specimens were used. The first (outer) leaf of flowering plants was measured for length from the point at which it and the second leaf diverge and, for width, one centimeter below the leaf apex. The latter does not represent the widest point of the leaf and is not comparable to figures obtained by Knerr (1891a), Meads (1893) and Ireland (1957). Thirty-four specimens of *E. albidum* examined had an average length of 13.4 cm (8.0-22.0 cm), and an average width of 1.2 cm (0.6-2.0 cm). Sixty-four specimens of *E. mesochoreum* had an average length of 8.3 cm (5.0-13.6 cm), and an average width of 0.7 cm (0.2-1.2 cm). A leaf index was compiled using the length divided by the width as measured above and for *E. albidum* the average index was 11.4 (6.5-21.5) while for *E. mesochoreum* the average index was 12.9 (5.7-34.9). These show that although leaves of the latter species tend to be smaller, the proportion of length to width varies more within a species than between them.

Leaf width was measured 1 cm below the leaf tip so that an index could be compiled to measure the amount of pointedness at the tip. The index was made by dividing the width by 1 cm. The average index for *E. albidum* was 1.2 (mean 1.2, range 0.6-2.0), whereas *E. mesochoreum* had an average index of 0.6 (mean 0.6, range 0.2-1.2). This indicates that the leaves of the latter species are more gradually tapered toward the tip while those of the former are more abruptly attenuated.

Leaf mottling is a useful field character as the leaves of *E. albidum* are typically mottled while those of *E. mesochoreum* are not mottled. However, some leaves of *E. albidum* were seen with little mottling and two colonies of *E. mesochoreum* were found distinctly mottled. Also, as the season progresses, the purple pigment causing mottling disappears leaving splotches of light green and when specimens of *E. albidum* are dried, the mottling usually fades.

Leaf folding is also a valuable field character, for the leaves of *E. mesochoreum* are normally conduplicate while those of *E. albidum* are usually flat or half-folded at the most.

Floral morphology.

Reports by previous workers and personal observations indicate that there are no reliable floral differences between *E. albidum* and *E. mesochoreum*, except that the perianth in the former species is usually completely reflexed in full bloom while that of the latter is spreading or at most half-reflexed.

Fruit morphology.

Mature capsules of *E. albidum* average 1.6 cm (1.0-2.2) in length and 1.0 cm (0.7-1.3 cm) in width while those of *E. mesochoreum* average 1.4 cm (1.1-2.0) in length and 0.9 cm (0.6-1.7 cm) in width. These data indicate that fruit size is not a significant character as suggested by Knerr (1891a). However, the manner in which the mature capsule is held is indicative of the species. The fruit of *E. albidum* is held erect on a more or less erect peduncle, while the tip of the capsule of *E. mesochoreum* rests on the ground at the end of an arching peduncle. The capsule of both species is obovoid, that of *E. mesochoreum* having a distinct indentation at the tip while that of *E. albidum* is rounded, slightly apiculate, or with a slight indentation.

Vegetative reproduction.

The method of vegetative reproduction of sterile forms varies in the following ways:

	<i>Stolons</i>	<i>Droppers</i>	<i>Offsets</i>
<i>E. mesochoreum</i>	0	36 (13%)	245 (87%)
<i>E. albidum</i>	181 (56%)	5 (2%)	139 (42%).

The relevant features are the lack of stolons and the production of some droppers in *E. mesochoreum* with the formation of offsets as the major mode of vegetative reproduction. In *E. albidum* a significant number of sterile plants reproduced by offsets although the majority formed stolons. Flowering plants of both species regularly produce offsets. It was noted that these offsets are usually lateral in flowering plants, but often vertical in the sterile forms.

Chromosome numbers and morphology (Appendix 1).

The chromosome number of *E. mesochoreum* was found to be $2n = 22$ which confirms the reports of Ireland (1957) and Smith (1965). Eight of the chromosomes are metacentric or submetacentric while 14 are acrocentric. *Erythronium albidum* has $2n = 44$ as reported by Cooper (1939) and Ireland (1957). Sixteen chromosomes are metacentric or submetacentric while 28 are acrocentric. These species are the only members of the genus reported with a basic number of $x = 11$ and with metacentric or submetacentric chromosomes. No plant was found with an intermediate number of $2n = 33$ among 23 collections studied, including plants from a population where the two species were found together.

In summary, the two white-flowered species may be distinguished by a combination of the following characters:

<i>mesochoreum</i>	<i>albidum</i>
Leaves gradually attenuated	Leaves abruptly attenuated
Leaves not mottled	Leaves mottled
Leaves conduplicate	Leaves flat
Perianth spreading	Perianth reflexed
Fruit resting on ground	Fruit held erect
Sterile forms forming offsets and droppers	Sterile forms forming stolens and offsets
Chromosome number $2n = 22$	Chromosome number $2n = 44$
Prairies, pastures, dry woods.	Moist woods

SYSTEMATIC TREATMENT

Three species of *Erythronium* recognized in Kansas.

- a. Perianth segments yellow, auricles present; underside of leaves not glaucous
.....1. *E. rostratum*
- aa. Perianth segments white, auricles absent; underside of leaves glaucous.
 - b. Perianth segments reflexed in full bloom; leaves mottled; mature fruits held off
ground; moist woods2. *E. albidum*
 - bb. Perianth segments spreading to at most half-reflexed in full bloom; leaves not
mottled; mature fruits resting on ground; prairies, pastures, dry open woods
.....3. *E. mesochoreum*

1. ERYTHRONIUM ROSTRATUM Wolf, Castanea 6: 24, 1941.

Herb perennating by underground corm. *Leaves* 2 in flowering forms, 1 in immature forms, tapering into petioles which sheath the base of scape, strongly mottled on adaxial side at flowering with purplish-brown pigment, not glaucous. *Inflorescence* solitary at tip of scape. *Flowers* perfect with yellow tepals; outer tepals 3 with intense purplish-brown specks on abaxial side; inner tepals 3 with well developed auricles at base which clasp the opposite filaments; stamens 6, filaments opposite inner tepals slightly longer than those opposite outer tepals, anthers yellow, those opposite inner tepals maturing before those opposite outer tepals; stigma lobes swollen, short and erect, style persistent and forming prominent beak on capsule. *Fruit* ellipsoidal capsule with beak, held erect at maturity.

Lectotype: ALABAMA: Blount Co, Warnock Mt, *Morgan s.n.*, 4 Apr 1938, St. Bernard College Herb 4224 (SB, not seen), islectotype (US).

Rich moist woods, especially along creek or river banks; northern & central Alabama, Tennessee, SE Kansas, SW & S central Missouri, E Oklahoma, NW Arkansas. Apparently not found in the lower Mississippi Valley. March-April.

KANSAS: Cherokee Co.

2. *ERYTHRONIUM ALBIDUM* Nutt., Gen. N. Amer. Pl. 223, 1818.

Herb perennating by underground corm. *Leaves* 2 in flowering forms, 1 in immature forms, tapering into petioles which sheath the base of scape, elliptical-lanceolate to ovate-lanceolate, flat to half-folded, mottled on both sides with purplish-brown or light green, glaucous on both sides. *Inflorescence* solitary at tip of scape. *Flowers* perfect with white tepals, often tinged on abaxial side with pink, blue or lavender; outer tepals 3; inner tepals 3, without auricles, yellow spot present at base; perianth segments usually completely reflexed in full bloom; stamens 6, filaments opposite inner tepals slightly longer than those opposite outer tepals, anthers yellow, those opposite inner tepals maturing before those opposite outer tepals; stigmas trifold, lobes long and divergent, slender, style not persistent. *Fruit* obovate, held erect at maturity, rounded, slightly apiculate or slightly umbilicate at distal end.

Type: Unknown.

Moist dense woods, especially along slopes or banks overlooking creeks, lakes and rivers; Ontario and Minnesota south to Georgia, Kentucky, Missouri & Texas. March-early May.

KANSAS: Atchison, Bourbon, Brown, Cherokee, Cloud, Cowley, Crawford, Douglas, Geary, Jackson, Jefferson, Johnson, Labette, Leavenworth, Linn, Marshall, Miami, Montgomery, Neosho, Pottawatomie, Riley, Shawnee, Wabaunsee, Washington, Wilson & Wyandotte Counties.

3. *ERYTHRONIUM MESOCHOREUM* Knerr, Mid. College Monthly **2**: 5, 1891.

E. albidum Nutt. var. *mesochoreum* (Knerr) Rickett, Rhodora **39**: 105, 1937.

Herb perennating by underground corm. *Leaves* 2 in flowering forms, 1 in immature forms, tapering into petioles which sheath the base of scape, lanceolate to linear-lanceolate, conduplicate or occasionally half-folded, usually not mottled, glaucous on both sides. *Inflorescence* solitary at tip of scape. *Flowers* perfect with white tepals, often tinged on abaxial side with blue or lavender; outer tepals 3; inner tepals 3, without auricles, yellow spot present at base, perianth segments spreading or at most half-reflexed in full bloom; stamens 6, the filaments opposite the inner tepals slightly longer than those opposite the outer tepals; anthers yellow, those opposite the inner tepals maturing before those opposite outer tepals; stigmas trifold, lobes long and divergent, slender, style not persistent on fruit; *Fruit* obovate, resting on ground at maturity, umbilicate at distal end.

Neotype: KANSAS: Atchison Co, Atchison, Knerr s.n., 24 Apr 1891 (MO). No specimen was cited with the original description. This specimen selected as the neotype was collected by Knerr in the same locality where he found the new species and in the same year as the original description. The specimen matches the type description and possibly was from the material used by Knerr. In the Missouri Botanical Garden herbarium are two letters written by Knerr to Dr. W. Trelease. The first was written shortly before *E. mesochoreum* was published (Apr 24, 1891) and mentions specimens of both *E. albidum* and "*E. ?*" sent by Knerr to Trelease requesting the latter's aid in determining the material marked

"*E. ?*". In a second letter (May 13, 1891) Knerr stated that he had described the heretofore unknown material as *E. messachoreum* and enclosed a copy of the original description.

Prairies, pastures, and dry open woods; Iowa, Missouri, E Nebraska, E Kansas, Oklahoma, and Texas. March-April.

KANSAS: Allen, Anderson, Atchison, Bourbon, Butler, Chautauqua, Cherokee, Cloud, Crawford, Douglas, Franklin, Geary, Greenwood, Lyon, Morris, Neosho, Osage, Saline, Shawnee, Wabaunsee, Wilson & Woodson Counties.

EXCLUDED SPECIES

Knerr (1891a) reported *E. propullans* Gray from Kansas; no one has since collected it in the state. I have examined a specimen identified as the species from Davis Co (now part of Geary Co), *Panton s.n.*, 1879 (KCS) and although the sheet has only sterile forms each has stolons arising from the corms (characteristic of *E. albidum* in this region) instead of offshoots arising from about midway on the stem as is found in *E. propullans*. It seems unlikely that *E. propullans* occurs so far south from its normal range in Minnesota.

Smyth (1892) reported the Kansas distribution of *E. americanum* from Kansas City west to Manhattan and Junction City. I have examined *Smyth 1012* (Shawnee Co, 1887, KSC) and this specimen is *E. albidum*; very possibly Smyth confused the two species and I suspect his distribution for *E. americanum* is erroneous. No one has since collected the species in this area.

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APPENDIX 1

Cytological Materials, Techniques & Results

Stolon tips of *E. rostratum*, *E. albidum*, and young ovaries of *E. mesochoreum* were placed in a solution of 2% colchicine for 2 hours and fixed in modified Carnoy's fluid of 6 parts 95% ethanol, 2 parts propionic acid, and 2 parts chloroform. The growing tip of a stolon or a young ovule was dissected out and hydrolyzed in 10% HCl for 2-5 minutes, rinsed with fixative, teased apart in a drop of saturated propionocarmine and macerated gently.

Voucher specimens (all *Robertson*) are deposited at the University of Kansas (KANU) and many duplicates at the Missouri Botanical Garden (MO).

Erythronium rostratum Wolf: **2n = 24**. Kansas: Cherokee Co, 3 mi N of Baxter Springs, 121 (KANU, MO), 124 (KANU); 3.5 mi N of Galena, 127 (KANU, MO).

E. albidum Nutt.: **2n = 44**. Kansas: Cherokee Co, 3 mi N of Baxter Springs, 125 (KANU, MO); Douglas Co, 4 mi NW of Lawrence, 129 (KANU); Linn Co, Marais Des Cygne Waterfowl Refuge, 132, 146 (KANU, MO); Miami Co, SE part of Miami Co State Lake, 133 (KANU, MO); SW part of Miami Co State Lake, 134 (KANU, MO); Johnson Co, 4 mi E of Eudora, 135 (KANU, MO).

E. mesochoreum Knerr: **2n = 22**. Kansas: Allen Co, 2 mi N of Mildred, 118; Anderson Co, 11 mi S of Garnett, 117; Cherokee Co, 2.5 mi S of Galena, 122 (KANU, MO); 3 mi N of Baxter Springs, 126 (KANU); Crawford Co, N edge of Pittsburg, 148 (KANU, MO); Douglas Co, University of Kansas campus 115; 4 mi NW of Lawrence, 128 (KANU); Neosho Co, 2 mi E of Neosho Co State Lake, 120 (KANU, MO); Osage Co, 1 mi E of Vassar, 130 (KANU, MO); Shawnee Co, 2 mi S of Forbes AFB, 131 (KANU, MO); 1.25 mi E of Dover, 143 (KANU, MO); Wabaunsee Co, 2 mi N & 0.5 mi W of Dover, 145 (KANU, MO). Missouri: Barton Co, 2 mi E of Mindenmines, 140 (KANU, MO).